FOREST PEST MANAGEMENT
Pacific Southwest Region

84 2546

Report No. 84-10

3430 Evaluation
April 12, 1984

ECONOMIC ANALYSIS OF TREATING A ROOT DISEASE - BARK BEETLE COMPLEX, THE CAUSE OF TREE MORTALITY ON MCCLOUD FLATS, SHASTA-TRINITY NATIONAL FORESTS

Dennis Hart, Entomologist

PSW FOREST AND RANGE EXPERIMENT STATION
MAY 9 1984
STATION LIBRARY COPY

ABSTRACT

This report documents an analysis of the economic worth of sound, aggressive silvicultural practices, which incorporate forest pest management considerations which are being used to control chronic tree mortality on McCloud Flats, Shasta-Trinity National Forests. Light, scattered tree mortality, with large patches of heavy mortality, is occurring over an area of 10,000 acres. The main pest complex causing this mortality is black stain root disease, annosus root disease, and western pine beetle.

The analysis is based on two types of economic valuation: present net value (PNV) and benefit/cost ratio (B/C).

The following stand management options, advanced in FPM biological evaluations of the area, constitute the remedial treatment chosen by the McCloud District for this pest condition:

Dead-tree salvage.

Green tree sales (clear cuts) at mortality centers, including the cutting of buffer zones around the infected areas.

Restocking areas (clear cuts) intensively infected.

This treatment will be implemented until the affected stands (currently 80 years) reach rotation age in about 40 years.

The program phases and the values determined for this analysis are:

USDA, FOREST SERVICE, PACIFIC SOUTHWEST REGION
State and Private Forestry, Forest Pest Management
630 Sansome Street, San Francisco, California 94111

	Treated	Untreated	Change Between Treated and Untreated
A. Benefits			
Harvest Value:			
Green	$6,555,042	$5,803,342	
Salvage	65,031	256,700	
Residual Stand Value	839,000	783,850	Benefit
Total	$7,459,073	$6,843,892	$615,181
B. Costs			
Management Costs:			
Green Sale Costs	$1,406,099	$1,145,995	
Salvage Sale Costs	55,741	220,029	
			Cost
Total	$1,461,840	$1,366,024	$95,816

PNV = $519,365 = The value of Resources Saved

B/C = 6.4

By investing $95,816 more than would have been spent without remedial treatments, the Forest will gain $615,181: a profit of $519,365. The B/C ratio for this investment is 6.4.

INTRODUCTION

The purpose of this report is to document an analysis of the economic worth of silvicultural treatments, which include insect and disease considerations, which are being applied in a large (29,000 acres) timber-producing area plagued with high chronic tree mortality. The analysis is based on two types of economic valuation: present net value (PNV) and benefit/cost ratio (B/C). PNV is the value now of sums of money, minus all costs, arising in the future. B/C analysis identifies the social costs and benefits of investment projects to help determine whether they should be undertaken, using the perspective of economic benefit.

There continues to be a high rate of tree mortality on McCloud Flats, McCloud Ranger District, Shasta-Trinity National Forests, dating from 1967. Even before that, the rate of tree mortality - although lower - was troublesome, particularly in 1959, and again in 1964.

The McCloud Flats area is stocked predominantly with even-aged stands of saw-timber-size ponderosa pine, about 80 years old. During the past 10 years, several thinning and salvage sales have been made on the flats, but the resulting stands contain many areas which are still overstocked. The area, approximately 29,000 acres, is bounded by the Edison Creek Road, Pilgrim Creek Road, and Highway 89. Tree mortality is typically scattered, with occasional groups of dead trees. Mortality is particularly high at Edison Creek, Pilgrim Creek and Widow Springs.

In October 1976, Bruce Roettgering (entomologist) and Richard Smith (pathologist), Forest Pest Management Staff, Region 5, conducted a biological evaluation of the tree mortality on McCloud Flats and observed unusually heavy group-tree mortality along the Edison Creek Road in sections 2,11, and 14 of Township 40 North, Range 1 West, Mount Diablo Meridian. This tree mortality was associated primarily with Ceratocystis wageneriі, the cause of black stain root disease; Heterobasidion annosum, (Fomes annosus), a root rot fungus; and Dendroctonus brevicomis, the western pine beetle. Most mortality resulted from black stain root disease, with the western pine beetle exploiting the diseased trees. Annosus root disease was involved to a limited extent. The prognosis was that the black stain root disease would continue to spread and cause tree death at about the same rate in the future.

In October 1979, Forest Pest Management pathologists John Kliejunas, John Pronos and Gregg DeNitto examined tree mortality in the Pilgrim Creek thinning sale area in Township 40 North, Range 1 West, Sections 7 and 8. They found that in this area the root decay caused by annosus root disease is more prevalent than the black stain root disease.

About 10,000 acres are affected by this tree mortality problem. 2,500 acres have concentrated tree mortality; on 230 acres the problem was so great that the stand was clear cut.

REMEDIAL STAND TREATMENT ACTIONS

From the biological evaluations of 1976 and 1979, Forest personnel selected and implemented the following stand management actions: salvage dead trees, increase patch cutting in affected areas, cut buffer zones of uninfected trees around major root disease centers, and plant cut-over areas with resistant tree species or brush to control the root disease/bark beetle problem.

Dead trees are to be salvaged as soon as possible in order to recover the highest value. If the dead trees are removed prior to beetle emergence, some additional benefits would accrue if attacks were reduced in adjacent noninfested trees.

By increasing the size of the patch cut so that all dead trees, all unthrifty trees, and all trees within a 75 foot buffer strip of the outermost infected tree are removed, it is highly probable that most of the currently infected trees will be removed and that the surrounding stands will not have to be entered again for salvage purposes. The intent of the buffer strip is to stop the spread of this root disease by limiting contact between infested roots and roots of the uninfected living trees in the surrounding stand.

Restocking these areas with trees or brush species resistant to root disease is intended to eliminate the root disease and keep these areas in full production in future years.

BENEFITS

Volume:

Green Sales.
Salvage.
Increased volume of residual stand at rotation age.

Increased acreage kept in production.

COSTS

Forest Pest Mangement biological evaluations.

Sales layout.

Sales administration.

Site preparation and planting.

ASSUMPTIONS

Tree mortality is scattered throughout a 10,000-acre area on McCloud Flats. This area is primarily stocked with stands of evenaged ponderosa pine. Average age is 80 years. These stands are managed on a 120-year rotation. If nothing is done to treat this pest condition, about 10 percent of this area will go out of timber production over the next 40 years. If the problem areas are treated, and this treatment is 75 percent successful, only 0.10 X 0.25 = 2.5 percent of this area will go out of production.

Potential yield per acre in the Shasta National Forest standard component is: $\frac{101,400,000 \text{ BF}}{256,300 \text{ Acres}}$ = 396 BF/Acre (R5 Supp. No 183, 4/77, to FSM 2415.41--2).

The average stocking is 30,000 BF/Acre (from field inspection and yield table).

Assume that the Shasta-Trinity National Forests sells the potential yield in this area and that the yield is recalculated at 10-year intervals.

Green Sales

It is assumed that if the root disease/bark beetle pest complex impacting this area is not treated, 10 percent of this area (10% of 10,000 acres = 1,000 acres) will be taken out of production over the next 40 years. The rate of commercial timber land going out of production is 25 acres per year, or 250 acres per 10-year planning interval. At this rate the expected acreage of commercial timber land and potential volume of green sales for McCloud Flats for the 10-year planning periods without treatment are:

Beginning of Planning Interval	Commercial Timbered Acres	Green Sales/Year Volume MM BF
1980	10,000	3.96
1990	9,750	3.86
2000	9,500	3.76
2010	9,250	3.66
2020	9,000	3.56

If the problem areas are treated and the treatment is 75 percent successful, only 0.10 X 0.25 = 2.5 percent of the area will go out of production. At this rate, 250 acres will be expected to go out of production during this forty-year period. This will be about 62.5 acres going out of production per 10-year planning interval. At this rate the expected values for commmercial timber land and volume of potential yield in green sales for McCloud Flats for the planning periods with treatment are:

Beginning of Planning Interval	Commercial Timbered Acres	Green Sales/Year Volume MM BF
1980	10,000	3.96
1990	9,938	3.94
2000	9,875	3.91
2010	9,813	3.89
2020	9,750	3.86

Salvage Sales

Without-Treatment Harvests

If this pest condition is not treated, it is estimated that 1,000 acres of commercial timber land will go out of production over the next 40 years. From yield table data, the average stocking per acre on McCloud Flats is 30,000 BF/Acre. Therefore, 0.75 MMBF/year is expected to go out of production for a 40-year period without treatment.

$$\frac{(1{,}000 \text{ acres} \times 30 \text{ MBF})}{40 \text{ YEARS}} = 0.75 \text{ MMBF/YEAR}$$

With-Treatment Harvests

If this pest condition is treated, it is estimated that 250 acres of commercial timber land will go out of production over the next 40 years. This means that 0.19 MMBF/year is expected to go out of production for a 40-year period with treatment.

$$\frac{(250 \text{ acres} \times 30 \text{ MBF})}{40 \text{ years}} = 0.19 \text{ MMBF/year}$$

Valuation of Effects of Pest Damage

Valuations on timber volumes[1/] are:

Green sale price = $131/MBF

Salvage price = $35/MBF

Timber Management costs for sale preparation and administration are $30/MBF (from Regional budget and Forest data).

The net revenues are:

Green sales: $101/MBF

Salvage sales: $5/MBF

1/ Ruderman; Florence K. 1978. Production, Prices, Employment, and Trends in Northwest Forest Industries. Second Quarter 1978. Table 51. Pacific Northwest Forest and Range Experiment Station. USDA. Forest Service. Portland, Oregon.

1978 values were used for this analysis because the valuation should be made at the time the biological evaluation was written.

In 1982, 220 acres were treated with a herbicide spray. This area was fenced to keep cattle from grazing in the area. This cost was $25 per acre for a total of $5,000.

During the growing season of 1983 the planted Douglas-fir trees on 230 acres were shaded. This cost $70 per acre for a total of $16,100. At this time this area was also treated with the release herbicide Velpar for a total cost of $12,880.

CALCULATIONS

Tables 1 and 2 (in the Appendix) list the benefit/cost time stream for green and salvage sales on McCloud Flats for the period 1980 to 2020. They also give the benefit/cost valuations for this period. Table 1 gives calculations for the benefit-cost time stream. Table 2 gives the treatment valuation.

The values from these tables which apply to the program phases are:

	Treated	Untreated	Change Between Treated and Untreated
A. Benefits			
Harvest Value:			
Green	$6,555,042	$5,803,342	
Salvage	65,031	256,700	
Residual Stand Value	839,000	783,850	Benefit
Total	$7,459,073	$6,843,892	$615,181
B. Costs			
Management Costs:			
Green Sale Costs	$1,406,099	$1,145,995	
Salvage Sale Costs	55,741	220,029	
			Cost
Total	$1,461,840	$1,366,024	$95,816

PNV = $519,365 = Value of Resources Saved

B/C = 6.4

The value of resources saved due to the remedial stand treatments is equal to the PNV of the total program with treatment minus the PNV of the total program without treatment. The value of resources saved is the difference in these values: $519,365.

The present value of treatment costs is $95,816 greater than the non-treatment costs. Similarly, the present value of treatment benefits is $615,181 greater than the benefits gained without the remedial treatment. The B/C ratio for this relationship is 6.4.

CONCLUSIONS

Silvicultural treatment to reduce the tree mortality caused by root disease and bark beetle pest complexes is desirable because of the increase in total volume of green sales and reduction in dead tree salvage required. Total net revenue saved by treating this pest condition is expected to be $519,365. By investing $95,816 more than would have been spent without remedial treatments, the Forest will gain $615,181: a profit of $517,365. The B/C ratio for this investment is 6.4.

APPENDIX

TABLES FOR ECONOMIC VALUATION

TABLE	TITLE
1	Benefit- Cost Time Stream
2	Treatment Valuation

GROSS REVENUES AND COSTS
BENEFIT - COST TIME STREAM
MCCLOUD FLATS TIMBER HARVESTS

Year	Timber Sales MMBF				Timber Sale Revenues				Timber Sale Costs				Total Sales		Total Costs	
	Green Sales		Salvage Sales		Green Sales		Salvage Sales		Green Sales		Salvage Sales					
	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without
1	7.77	3.96	0.19	0.75	$ 1,020,978	$ 520,344	$6,650	$26,250	$308,100	$118,800	$5,700	$22,500	$1,027,628	$546,594	$313,800	$141,300
2	5.69	3.96	0.19	0.75	747,666	520,344	6,650	26,250	181,950	118,800	5,700	22,500	754,316	546,594	187,650	141,300
3	3.96	3.96	0.19	0.75	520,344	520,344	6,650	26,250	123,800	118,800	5,700	22,500	526,994	546,594	129,500	141,300
4	3.96	3.96	0.19	0.75	520,344	520,344	6,650	26,250	147,800	118,800	5,700	22,500	526,994	546,594	153,500	141,300
5	3.96	3.96	0.19	0.75	520,344	520,344	6,650	26,250	118,800	118,800	5,700	22,500	526,994	546,594	124,500	141,300
6	3.96	3.96	0.19	0.75	520,344	520,344	6,650	26,250	118,800	118,800	5,700	22,500	526,994	546,594	124,500	141,300
7	3.96	3.96	0.19	0.75	520,344	520,344	6,650	26,250	118,800	118,800	5,700	22,500	526,994	546,594	124,500	141,300
8	3.96	3.96	0.19	0.75	520,344	520,344	6,650	26,250	118,800	118,800	5,700	22,500	526,994	546,594	124,500	141,300
9	3.96	3.96	0.19	0.75	520,344	520,344	6,650	26,250	118,800	118,800	5,700	22,500	526,994	546,594	124,500	141,300
10	3.96	3.96	0.19	0.75	520,344	520,344	6,650	26,250	118,800	118,800	5,700	22,500	526,994	546,594	124,500	141,300
11	3.94	3.86	0.19	0.75	517,716	507,204	6,650	26,250	118,200	115,800	5,700	22,500	524,366	533,454	123,900	138,300
12	3.94	3.86	0.19	0.75	517,716	507,204	6,650	26,250	118,200	115,800	5,700	22,500	524,366	533,454	123,900	138,300
13	3.94	3.86	0.19	0.75	517,716	507,204	6,650	26,250	118,200	115,800	5,700	22,500	524,366	533,454	123,900	138,300
14	3.94	3.86	0.19	0.75	517,716	507,204	6,650	26,250	118,200	115,800	5,700	22,500	524,366	533,454	123,900	138,300
15	3.94	3.86	0.19	0.75	517,716	507,204	6,650	26,250	118,200	115,800	5,700	22,500	524,366	533,454	123,900	138,300

Year	Timber Sales MMBF				Timber Sale Revenues				Timber Sale Costs				Total Sales		Total Costs	
	Green Sales		Salvage Sales		Green Sales		Salvage Sales		Green Sales		Salvage Sales					
	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without
16	3.94	3.86	0.19	0.75	517,716	507,204	6,650	26,250	118,200	115,800	5,700	22,500	524,366	533,454	123,900	138,300
17	3.94	3.86	0.19	0.75	517,716	507,204	6,650	26,250	118,200	115,800	5,700	22,500	524,366	533,454	123,900	138,300
18	3.94	3.86	0.19	0.75	517,716	507,204	6,650	26,250	118,200	115,800	5,700	22,500	524,366	533,454	123,900	138,300
19	3.94	3.86	0.19	0.75	517,716	507,204	6,650	26,250	118,200	115,800	5,700	22,500	524,366	533,454	123,900	138,300
20	3.94	3.86	0.19	0.75	517,716	507,204	6,650	26,250	118,200	115,800	5,700	22,500	524,366	533,454	123,900	138,300
21	3.91	3.76	0.19	0.75	513,774	494,064	6,650	26,250	117,300	112,800	5,700	22,500	520,424	520,314	123,000	135,300
22	3.91	3.76	0.19	0.75	513,774	494,064	6,650	26,250	117,300	112,800	5,700	22,500	520,424	520,314	123,000	135,300
23	3.91	3.76	0.19	0.75	513,774	494,064	6,650	26,250	117,300	112,800	5,700	22,500	520,424	520,314	123,000	135,300
24	3.91	3.76	0.19	0.75	513,774	494,064	6,650	26,250	117,300	112,800	5,700	22,500	520,424	520,314	123,000	135,300
25	3.91	3.76	0.19	0.75	513,774	494,064	6,650	26,250	117,300	112,800	5,700	22,500	520,424	520,314	123,000	135,300
26	3.91	3.76	0.19	0.75	513,774	494,064	6,650	26,250	117,300	112,800	5,700	22,500	520,424	520,314	123,000	135,300
27	3.91	3.76	0.19	0.75	513,774	494,064	6,650	26,250	117,300	112,800	5,700	22,500	520,424	520,314	123,000	135,300
28	3.91	3.76	0.19	0.75	513,774	494,064	6,650	26,250	117,300	112,800	5,700	22,500	520,424	520,314	123,000	135,300
29	3.91	3.76	0.19	0.75	513,774	494,064	6,650	26,250	117,300	112,800	5,700	22,500	520,424	520,314	123,000	135,300
30	3.91	3.76	0.19	0.75	513,774	494,064	6,650	26,250	117,300	112,800	5,700	22,500	520,424	520,314	123,000	135,300
31	3.89	3.66	0.19	0.75	511,146	480,924	6,650	26,250	116,700	109,800	5,700	22,500	517,796	507,174	122,400	132,300
32	3.89	3.66	0.19	0.75	511,146	480,924	6,650	26,250	116,700	109,800	5,700	22,500	517,796	507,174	122,400	132,300

Year	Timber Sales MMBF				Timber Sale Revenues				Timber Sale Costs				Total Sales		Total Costs	
	Green Sales		Salvage Sales		Green Sales		Salvage Sales		Green Sales		Salvage Sales					
	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without
33	3.89	3.66	0.19	0.75	511,146	480,924	6,650	26,250	116,700	109,800	5,700	22,500	517,796	507,174	122,400	138,300
34	3.89	3.66	0.19	0.75	511,146	480,924	6,650	26,250	116,700	109,800	5,700	22,500	517,796	507,174	122,400	138,300
35	3.89	3.66	0.19	0.75	511,146	480,924	6,650	26,250	116,700	109,800	5,700	22,500	517,796	507,174	122,400	138,300
36	3.89	3.66	0.19	0.75	511,146	480,924	6,650	26,250	116,700	109,800	5,700	22,500	517,796	507,174	122,400	138,300
37	3.89	3.66	0.19	0.75	511,146	480,924	6,650	26,250	116,700	109,800	5,700	22,500	517,796	507,174	122,400	138,300
38	3.89	3.66	0.19	0.75	511,146	480,924	6,650	26,250	116,700	109,800	5,700	22,500	517,796	507,174	122,400	138,300
39	3.89	3.66	0.19	0.75	511,146	480,924	6,650	26,250	116,700	109,800	5,700	22,500	517,796	507,174	122,400	138,300
40	3.89	3.66	0.19	0.75	511,146	480,924	6,650	26,250	116,700	109,800	5,700	22,500	517,796	507,174	122,400	138,300

Table #2

TREE MORTALITY AT MCCLOUD FLATS
TREATMENT VALUATION

A. Value of Sales:

Costs

Economic Term	Treated		Untreated	
	Green	Salvage	Green	Salvage
PV	$1,406,099	$55,741	$1,145,995	$220,029

Benefits

PV	$6,555,042	$65,031	$5,803,342	$256,700

B. Value of the Residual Stands:

The present value of the residual stands in forty years is expected to be:

Treated	Untreated
$839,000	$783,850

C. Value of Resource Saved due to Treatment:

Resources Saved = Increased Benefit - Increased Cost

$519,365 = $615,181 - $95,816